CONFERENCE OF THE COMMITTEE ON DISARMAMENT

CCD/394
20 February 1973
Original: ENGLISH/SPANISH

MEXICO

Letter dated 20 February 1973 from the Leader of the delegation of Mexico to the Special Representative of the Secretary-General to the Conference of the Committee on Disarmament

My delegation considers that the contents of United Nations General Assembly document A/C.1/1026 of 3 November 1972 are of direct interest to the Conference of the Committee on Disarmament. I therefore request you to be so kind as to have it reproduced as a Conference document.

Accept, Sir, the assurances of my highest consideration.

(Signed) Alfonso García Robles
Leader of the delegation of Mexico
to the Committee on Disarmament

GE.73-42392
73-06023

GENERAL AND COMPLETE DISARMAMENT

Letter dated 3 November 1972 from the Chairman of the delegation of Mexico to the twenty-seventh session of the General Assembly addressed to the Secretary-General

In view of the launching of negotiations between the Governments of the United States of America and the Union of Soviet Socialist Republics on the limitation of offensive and defensive strategic nuclear-weapon systems, the General Assembly, on 16 December 1969, adopted resolution 2602 A (XXIV), the last paragraph of which is worded as follows:

> "Appeals to the Governments of the Union of Soviet Socialist Republics and the United States of America to agree, as an urgent preliminary measure, on a moratorium on further testing and deployment of new offensive and defensive strategic nuclear-weapon systems."

Subsequently, during the twenty-fifth session, the Assembly recommended, in resolution 2661 C (XXV), that the comprehensive programme of disarmament reproduced in document A/8191 should be taken into account in future work and negotiations on disarmament.

Lastly, it should be remembered that the comprehensive programme of disarmament draws attention in its introduction to the need to establish effective procedures to ensure that the General Assembly be kept informed on the progress of "all negotiations and other acts on this matter, in whatever forum and form they may take place".

Taking into consideration the facts summarized above, as well as the frequent references made during the discussions in the First Committee to the results of the bilateral negotiations carried out between the United States of America and the Union of Soviet Socialist Republics, which are generally referred to as SALT I, the Mexican delegation feels that it is highly advisable for the General Assembly to include among its documents the official texts of the three instruments signed in Moscow, on 26 May 1972, by the aforementioned States.

It was for that reason that, on 23 October last, when the debate on the disarmament items began in the First Committee, after referring to the SALT I negotiations, I added that "we believe the Assembly has a right to be officially informed of their results, at the present session, by the participating States".

This is why, since that statement has not had the desired effect, I would request you to circulate the three bilateral instruments whose titles are given below as a General Assembly document under item 30 of the agenda for the twenty-seventh session. I have the honour to enclose with this note the texts of the instruments as reproduced in the relevant official publication of the Government of the United States of America:

(a) Treaty between the United States of America and the Union of Soviet Socialist Republics on the limitation of anti-ballistic missile systems;

(b) Interim Agreement between the United States of America and the Union of Soviet Socialist Republics on certain measures with respect to the limitation of strategic offensive arms;

(c) Protocol to the Interim Agreement between the United States of America and the Union of Soviet Socialist Republics on certain measures with respect to the limitation of strategic offensive arms.

(Signed) Alfonso GARCIA ROBLES
Chairman of the delegation of Mexico to the twenty-seventh session of the United Nations General Assembly

TREATY BETWEEN THE UNITED STATES OF AMERICA AND THE UNION OF SOVIET SOCIALIST REPUBLICS ON THE LIMITATION OF ANTI-BALLISTIC MISSILE SYSTEMS

The United States of America and the Union of Soviet Socialist Republics, hereinafter referred to as the Parties,

Proceeding from the premise that nuclear war would have devastating consequences for all mankind,

Considering that effective measures to limit anti-ballistic missile systems, would be a substantial factor in curbing the race in strategic offensive arms and would lead to a decrease in the risk of outbreak of war involving nuclear weapons,

Proceeding from the premise that the limitation of anti-ballistic missile systems, as well as certain agreed measures with respect to the limitation of strategic offensive arms, would contribute to the creation of more favorable conditions for further negotiations on limiting strategic arms,

Mindful of their obligations under Article VI of the Treaty on the Non-Proliferation of Nuclear Weapons,

Declaring their intention to achieve at the earliest possible date the cessation of the nuclear arms race and to take effective measures toward reductions in strategic arms, nuclear disarmament, and general and complete disarmament,

Desiring to contribute to the relaxation of international tension and the strengthening of trust between States,

Have agreed as follows:

ARTICLE I

1. Each Party undertakes to limit anti-ballistic missile (ABM) systems and to adopt other measures in accordance with the provisions of this Treaty.

2. Each Party undertakes not to deploy ABM systems for a defense of the territory of its country and not to provide a base for such a defense, and not to deploy ABM systems for defense of an individual region except as provided for in Article III of this Treaty.

ARTICLE II

1. For the purposes of this Treaty an ABM system is a system to counter strategic ballistic missiles or their elements in flight trajectory, currently consisting of:

(a) ABM interceptor missiles, which are interceptor missiles constructed and deployed for an ABM role, or of a type tested in an ABM mode;

(b) ABM launchers, which are launchers constructed and deployed for launching ABM interceptor missiles; and

(c) ABM radars, which are radars constructed and deployed for an ABM role, or of a type tested in an ABM mode.

2. The ABM system components listed in paragraph 1 of this Article include those which are:

(a) operational;

(b) under construction;

(c) undergoing testing;

(d) undergoing overhaul, repair or conversion; or

(e) mothballed.

ARTICLE III

Each Party undertakes not to deploy ABM systems or their components except that:

(a) within one ABM system deployment area having a radius of one hundred and fifty kilometers and centered on the Party's national capital, a Party may deploy: (1) no more than one hundred ABM launchers and no more than one hundred ABM interceptor missiles at launch sites, and (2) ABM radars within no more than six ABM radar complexes, the area of each complex being circular and have a diameter of no more than three kilometers; and

(b) within one ABM system deployment area having a radius of one hundred and fifty kilometers and containing ICBM silo launchers, a Party may deploy: (1) no more than one hundred ABM launchers and no more than one hundred ABM interceptor missiles at launch sites, (2) two large phased-array ABM radars comparable in potential to corresponding ABM radars operational or under construction on the date of signature of the Treaty in an ABM system deployment area containing ICBM silo launchers, and (3) no more than eighteen ABM radars each having a potential less than the potential of the smaller of the above-mentioned two large phased-array ABM radars.

ARTICLE IV

The limitations provided for in Article III shall not apply to ABM systems or their components used for development or testing, and located within current or additionally agreed test ranges. Each Party may have no more than a total of fifteen ABM launchers at test ranges.

ARTICLE V

1. Each Party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based, or mobile land-based.

2. Each Party undertakes not to develop, test, or deploy ABM launchers for launching more than one ABM interceptor missile at a time from each launcher, nor to modify deployed launchers to provide them with such a capability, nor to develop, test, or deploy automatic or semi-automatic or other similar systems for rapid reload of ABM launchers.

ARTICLE VI

To enhance assurance of the effectiveness of the limitations on ABM systems and their components provided by this Treaty, each Party undertakes:

(a) not to give missiles, launchers, or radars, other than ABM interceptor missiles, ABM launchers, or ABM radars, capabilities to counter strategic ballistic missiles or their elements in flight trajectory, and not to test them in an ABM mode; and

(b) not to deploy in the future radars for early warning of strategic ballistic missile attack except at locations along the periphery of its national territory and oriented outward.

ARTICLE VII

Subject to the provisions of this Treaty, modernization and replacement of ABM systems or their components may be carried out.

ARTICLE VIII

ABM systems or their components in excess of the numbers or outside the areas specified in this Treaty, as well as ABM systems or their components prohibited by this Treaty, shall be destroyed or dismantled under agreed procedures within the shortest possible agreed period of time.

ARTICLE IX

To assure the viability and effectiveness of this Treaty, each Party undertakes not to transfer to other States, and not to deploy outside its national territory, ABM systems or their components limited by this Treaty.

ARTICLE X

Each Party undertakes not to assume any international obligations which would conflict with this Treaty.

ARTICLE XI

The Parties undertake to continue active negotiations for limitations on strategic offensive arms.

ARTICLE XII

1. For the purpose of providing assurance of compliance with the provisions of this Treaty, each Party shall use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law.

2. Each Party undertakes not to interfere with the national technical means of verification of the other Party operating in accordance with paragraph 1 of this Article.

3. Each Party undertakes not to use deliberate concealment measures which impede verification by national technical means of compliance with the provisions of this Treaty. This obligation shall not require changes in current construction, assembly, conversion, or overhaul practices.

ARTICLE XIII

1. To promote the objectives and implementation of the provisions of this Treaty, the Parties shall establish promptly a Standing Consultative Commission, within the framework of which they will:

(a) consider questions concerning compliance with the obligations assumed and related situations which may be considered ambiguous;

(b) provide on a voluntary basis such information as either Party considers necessary to assure confidence in compliance with the obligations assumed;

(c) consider questions involving unintended interference with national technical means of verification;

(d) consider possible changes in the strategic situation which have a bearing on the provisions of this Treaty;

(e) agree upon procedures and dates for destruction or dismantling of ABM systems or their components in cases provided for by the provisions of this Treaty;

(f) consider, as appropriate, possible proposals for further increasing the viability of this Treaty, including proposals for amendments in accordance with the provisions of this Treaty;

(g) consider, as appropriate, proposals for further measures aimed at limiting strategic arms.

2. The Parties through consultation shall establish, and may amend as appropriate, Regulations for the Standing Consultative Commission governing procedures, composition and other relevant matters.

ARTICLE XIV

1. Each Party may propose amendments to this Treaty. Agreed amendments shall enter into force in accordance with the procedures governing the entry into force of this Treaty.

2. Five years after entry into force of this Treaty, and at five year intervals thereafter, the Parties shall together conduct a review of this Treaty.

ARTICLE XV

1. This Treaty shall be of unlimited duration.

2. Each Party shall, in exercising its national sovereignty, have the right to withdraw from this Treaty if it decides that extraordinary events related to the subject matter of this Treaty have jeopardized its supreme interests. It shall give notice of its decision to the other Party six months prior to withdrawal from the Treaty. Such notice shall include a statement of the extraordinary events the notifying Party regards as having jeopardized its supreme interests.

ARTICLE XVI

1. This Treaty shall be subject to ratification in accordance with the constitutional procedures of each Party. The Treaty shall enter into force on the day of the exchange of instruments of ratification.

2. This Treaty shall be registered pursuant to Article 102 of the Charter of the United Nations.

DONE at Moscow on May 26, 1972, in two copies, each in the English and Russian languages, both texts being equally authentic.

For the United States of America:

RICHARD NIXON,
President of the United States of America.

For the Union of Soviet Socialist Republics:

L. I. BREZHNEV,
General Secretary of the Central Committee of the CPSU.

INTERIM AGREEMENT BETWEEN THE UNITED STATES OF AMERICA AND THE UNION OF SOVIET SOCIALIST REPUBLICS ON CERTAIN MEASURES WITH RESPECT TO THE LIMITATION OF STRATEGIC OFFENSIVE ARMS

The United States of America and the Union of Soviet Socialist Republics, hereinafter referred to as the Parties,

Convinced that the Treaty on the Limitation of Anti-Ballistic Missile Systems and this Interim Agreement on Certain Measures with Respect to the Limitation of Strategic Offensive Arms will contribute to the creation of more favorable conditions for active negotiations on limiting strategic arms as well as to the relaxation of international tension and the strengthening of trust between States,

Taking into account the relationship between strategic offensive and defensive arms,

Mindful of their obligations under Article VI of the Treaty on the Non-Proliferation of Nuclear Weapons,

Have agreed as follows:

ARTICLE I

The Parties undertake not to start construction of additional fixed land-based intercontinental ballistic missile (ICBM) launchers after July 1, 1972.

ARTICLE II

The Parties undertake not to convert land-based launchers for light ICBMs, or for ICBMs of older types deployed prior to 1964, into land-based launchers for heavy ICBMs of types deployed after that time.

ARTICLE III

The Parties undertake to limit submarine-launched ballistic missile (SLBM) launchers and modern ballistic missile submarines to the numbers operational and under construction on the date of signature of this Interim Agreement, and in addition to launchers and submarines constructed under procedures established by the Parties as replacements for an equal number of ICBM launchers of older types deployed prior to 1964 or for launchers on older submarines.

ARTICLE IV

Subject to the provisions of this Interim Agreement, modernization and replacement of strategic offensive ballistic missiles and launchers covered by this Interim Agreement may be undertaken.

ARTICLE V

1. For the purpose of providing assurance of compliance with the provisions of this Interim Agreement, each Party shall use national technical means of veritifcation at its disposal in a manner consistent with generally recognized principles of international law.

2. Each Party undertakes not to interfere with the national technical means of verification of the other Party operating in accordance with paragraph 1 of this Article.

3. Each Party undertakes not to use deliberate concealment measures which impede verification by national technical means of compliance with the provisions of this Interim Agreement. This obligation shall not require changes in current construction, assembly, conversion, or overhaul practices.

ARTICLE VI

To promote the objectives and implementation of the provisions of this Interim Agreement, the Parties shall use the Standing Consultative Commission established under Article XIII of the Treaty on the Limitation of Anti-Ballistic Missile Systems in accordance with the provisions of that Article.

ARTICLE VII

The Parties undertake to continue active negotiations for limitations on strategic offensive arms. The obligations provided for in this Interim Agreement shall not prejudice the scope or terms of the limitations on strategic offensive arms which may be worked out in the course of further negotiations.

ARTICLE VIII

1. This Interim Agreement shall enter into force upon exchange of written notices of acceptance by each Party, which exchange shall take place simultaneously with the exchange of instruments of ratification of the Treaty on the Limitation of Anti-Ballistic Missile Systems.

2. This Interim Agreement shall remain in force for a period of five years unless replaced earlier by an agreement on more complete measures limiting strategic offensive arms. It is the objective of the Parties to conduct active follow-on negotiations with the aim of concluding such an agreement as soon as possible.

3. Each Party shall, in exercising its national sovereignty, have the right to withdraw from this Interim Agreement if it decides that extraordinary events related

to the subject matter of this Interim Agreement have jeopardized its supreme interests. It shall give notice of its decision to the other Party six months prior to withdrawal from this Interim Agreement. Such notice shall include a statement of the extraordinary events the notifying Party regards as having jeopardized its supreme interests.

DONE at Moscow on May 26, 1972, in two copies, each in the English and Russian languages, both texts being equally authentic.

For the United States of America:

RICHARD NIXON,
President of the United States of America.

For the Union of Soviet Socialist Republics:

L. I. BREZHNEV,
General Secretary of the Central Committee of the CPSU.

PROTOCOL TO THE INTERIM AGREEMENT BETWEEN THE UNITED STATES OF AMERICA AND THE UNION OF SOVIET SOCIALIST REPUBLICS ON CERTAIN MEASURES WITH RESPECT TO THE LIMITATION OF STRATEGIC OFFENSIVE ARMS

The United States of America and the Union of Soviet Socialist Republics, hereinafter referred to as the Parties,

Having agreed on certain limitations relating to submarine-launched ballistic missile launchers and modern ballistic missile submarines, and to replacement procedures, in the Interim Agreement,

Have agreed as follows:

The Parties understand that, under Article III of the Interim Agreement, for the period during which that Agreement remains in force:

The U.S. may have no more than 710 ballistic missile launchers on submarines (SLBMs) and no more than 44 modern ballistic missile submarines. The Soviet Union may have no more than 950 ballistic missile launchers on submarines and no more than 62 modern ballistic missile submarines.

Additional ballistic missile launchers on submarines up to the above-mentioned levels, in the U.S. - over 656 ballistic missile launchers on nuclear-powered submarines, and in the U.S.S.R. - over 740 ballistic missile launchers on nuclear-powered submarines, operational and under construction, may become operational as replacements for equal numbers of ballistic missile launchers of older types deployed prior to 1964 or of ballistic missile launchers on older submarines.

The deployment of modern SLBMs on any submarine, regardless of type, will be counted against the total level of SLBMs permitted for the U.S. and the U.S.S.R.

This Protocol shall be considered an integral part of the Interim Agreement.

DONE at Moscow this 26th day of May, 1972.

FOR the United States of America:

Richard NIXON,
President of the United States of America.

For the Union of Soviet Socialist Republics:

L. I. BREZHNEV,
General Secretary of the Central Committee of the CPSU.

CONFERENCE OF THE COMMITTEE ON DISARMAMENT

CCD/395
6 March 1973
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SWEDEN

Working paper on the concept of amplified verification in relation to the prohibition of chemical weapons

The principal role of verification in disarmament treaties

The use of control methods is stipulated in a treaty in order to verify that the parties comply with their undertakings under that treaty. General models for different types of control can be worked out. However, the conditions in the field to be covered by a treaty determine the actual verification measures to be stipulated. This can be exemplified briefly: with regard to the comprehensive test ban, only one control measure (detection of underground explosions) is discussed; with regard to nuclear material, control of the production of only one substance (down to kilogram quantities) by means of several methods is discussed. In contrast, a possible treaty prohibiting the development, production and stockpiling*/ of chemical agents of warfare will have to employ several control methods, covering not only several activities but also (tons of) many different chemical substances. This fact implies not only that usual decision theories are not easily applicable, but also that the question of false alarms must be given special attention. A discussion of these two aspects is attempted in the following. Practical and political implications are considered.

The role of verification in a ban on DPS of chemical agents of warfare

A chemical DPS ban covering several chemical agents will require several different control methods. This has become quite clear from the discussions in the CCD.

It has been argued, although no consensus has been reached so far, that the primary purpose of the many possible control methods in a future chemical ban should be to trigger some kind of procedure to establish whether a violation of the treaty has occurred or not. Furthermore, no agreement has been reached whether this procedure should involve on-site inspection or be restricted to some less intrusive

*/ The expression "development, production and stockpiling" is in the following abbreviated "DPS".

procedure. This part of the verification process will not be discussed in this paper. It is, however, assumed that the control methods discussed in the following are to be managed by an international control organization, using e.g. nationally gathered information for the purpose of control, as may be agreed upon in a treaty.

The necessity of using many control methods and the uncertainty as to the form for establishing a treaty violation makes it insufficient to consider the kind of discriminatory decision levels generated by a single verification measure which would apply in the case of the comprehensive test ban. Instead, it will be necessary to consider the effects of several verification measures in combination; in other words, to evaluate the amplified verification described later in this paper.

Amplification of verification efficiency

Much discussion has been devoted to how effective a non-intrusive method for the verification of the compliance with a disarmament treaty should be in order to deter its parties from violating the treaty, when subsequent on-site inspection is allowed or not, as the case may be. There seems to be consensus that the verification methods need in no case be 100 per cent effective.

Less attention seems to have been focused on the consequences of using several independent methods of verification, each with limited prospects of success, in revealing a violation. This is commented upon in the following, with special reference to the attempts to agree upon a ban on the DPS of chemical agents of warfare.

It is intuitively felt that the use of several independent methods of verification should increase the possibility of detecting treaty violations. Such an increase can easily be shown formally by applying a simple mathematical reasoning about probabilities. (See J. Lundin, Considerations on a chemical arms control treaty and the concept of amplified verification, FOA Reports 7:1 (1973) 1 - 5.)

To illustrate the effect of the amplification of the verification, one may consider the hypothetical situation concerning a ban on the DPS of chemical warfare agents given below. The revealing probabilities given in the example may be too high to be realistic, but then more methods can be introduced under the headings given. In a real case the given "revealing probabilities" should be evaluated by relevant experts, as discussed later.

Elements contained in an assumed prohibition of chemical arms and hypothetical verification results of their application

Forbidden activity	Possible verification method	Hypothetical values of revealing probabilities
Development		
Research on supertoxic substances, antidotes	Scanning literature by computer	0.03
Field tests	Remote sensing from satellites	0.1 */
Production	Statistical survey of export-import data for basic chemicals, e.g.	
	Phosphorus	0.03
	Phosphorus trichloride	0.03
Stockpiling	Finding instructions for handling of chemical munition	0.03
Training	Finding manuals on offensive use of chemical munition	0.01

*/ Cf. CCD/371, 1972.

False alarms

Evidently, the political drawbacks of a false alarm due to the performance of a control method are serious. That a nation, because of imperfect technical means, can be falsely accused of violating a treaty may to some parties be more objectionable than being left with a verification method that cannot detect every violation committed by other parties. It is thus important that the verification results be presented in a way that cannot be interpreted as an accusation. To achieve this is one of the aims of the verification model discussed in this paper.

It is assumed that the function of the accumulating circumstantial evidence from the several verification methods shall be to trigger such further investigatory procedures as may be agreed upon in a treaty. One could then foresee that requests for complementary information to back up quite normal findings about toxicological work, pesticide production, etc., obtained by the verification methods, would be considered as a normal routine procedure. Such a procedure would probably also make it easier to secure co-operation with industries.

The way of circumventing the problem of false alarms would lie in the insight and acceptance of the fact that each verification method is in itself a weak instrument which only in exceptional cases can give a straight answer, and which normally provides incomplete answers. Thus, there should be no reason to look upon a single result as an alarm, but rather as part of the continuous information procedure.

Need to give alarm alleging that a party has violated a treaty will arise only when several or all verification methods concur to indicate the possibility of a treaty violation, when requests made by routine for complementary information are rejected without reason, or when the information given turns out to be inconsistent with other information obtained.

The remaining genuine uncertainty

It might be questioned whether the application of the "amplified verification" system has a reassuring rather than a deterring effect on a party to the treaty. This may be described in the following way:

When two potentially adverse parties adhere to a treaty prohibiting production of chemical warfare agents, this implies that both parties officially wish to uphold the treaty. Being signatories of the treaty, neither wishes to be exposed as violating the treaty ban. At the same time, neither can accept that the other party could secretly violate the treaty. Thus the primary need is to have a verification system sufficiently reliable to expose to some degree an adverse violator. If one of the parties feels reassured about these possibilities, he can abstain from a capability of waging chemical war himself for any of three reasons: (1) he does not wish to have such a capability; (2) he would not need it, since an adversary can be expected to be disclosed at an acceptable level of probability (provided, as is done here, that this gives himself time to take countermeasures); (3) he would himself suffer the same risk as the adversary of being exposed by the verification system. From this reasoning it can be inferred that the reassuring effect would come first and thus in itself be sufficient.

The situation would essentially be the same if one or both of the parties already possessed a war-waging capability with chemical agents before becoming parties to the treaty. A treaty prescribing destruction of stockpiles would require verification methods for this, as well as for other activities covered by the treaty. Thus, by definition, the verification effect would be amplified again by introducing another control activity.

Thus, if it is possible to construct a reasonably reassuring control system, the problem would revert to the genuine uncertainty of whether some other power - perhaps

a potential adversary - intends in the future to acquire a chemical war capability. It can be assumed that any party entering into a treaty would expect other parties to observe the treaty obligations. The genuine uncertainty referred to above would therefore only relate to a more distant future. To assess this remains a political task, where one would have to take into account the option offered by the withdrawal clause in the treaty.

Practical and political implications

It may be interesting not only to determine how successful a verification method may be in disclosing a forbidden activity which is in effect not likely to occur. As suggested above one could e.g. also introduce a concept implying that a verification method investigates some normally occurring activity which is likely to undergo some change if and when a violation of the treaty is being prepared or is already taking place. The control method could be designed to analyse certain relevant data. The efficiency might be expressed through the confidence which experts would have in the verification method as to its ability to perform its task.

Politically, this means that it would be difficult for a country to start an activity in the field of chemical warfare which could go on totally unnoticed: warning signs would be obtained, even if they might be explained away.

Should several warnings appear simultaneously, they should certainly, taken together, be sufficient to warrant an investigation, if such a procedure is provided for in the treaty, or to entitle any party to withdraw from the treaty. Since the result of the verification methods would be official and be known by all parties, it would be easy for all other parties to judge the fairness of a withdrawal.

This procedure should therefore be easier to apply in the event that a suspected violator was unwilling to explain the coincidence of several "warning signs" or vetoed an investigation.

A withdrawal clause similar to the one just discussed hypothetically is found in the first DPS ban on biological and chemical agents of warfare, the convention on biological and toxin weapons.

Conclusions

The over-all efficiency of the verification system of a treaty prohibiting DPS of chemical agents is increased by the use of several verification methods. The verification methods may not be exclusively aimed at detecting violations, but could

primarily be designed to detect, with known efficiency, changes in normal activities in the chemical field. Such changes might constitute warning signs. The occurrence of many warning signs on behalf of a party to the treaty, in connexion with unwillingness to explain them or to let an investigation take place, might enable other parties to withdraw from the treaty. This construction of the verification system makes it reassuring rather than deterring. In view of the fact that the use of chemical warfare agents is already forbidden by the Geneva Protocol of 1925, such a reassurance should be sufficient.

CONFERENCE OF THE COMMITTEE ON DISARMAMENT

CCD/396
14 March 1973
Original: ENGLISH

BURMA, EGYPT, ETHIOPIA, MEXICO, MOROCCO,
NIGERIA, SWEDEN and YUGOSLAVIA

Memorandum

The delegations of Burma, Egypt, Ethiopia, Mexico, Morocco, Nigeria, Sweden and Yugoslavia deem it appropriate, at the outset of the 12th year of the existence of the Conference of the Committee on Disarmament, to state the following

1. They consider that the Conference of the Committee on Disarmament, which is the main multilateral negotiating body for disarmament, is of fundamental importance to the United Nations and the world community.

2. They also consider that the present international political situation is favourable for achieving further concrete results in the field of disarmament measures, adhering to the priorities established in the provisional agenda of the Committee and the relevant resolutions of the United Nations General Assembly.

3. Conscious of the responsibilities of the Conference of the Committee on Disarmament to mankind and to the United Nations, they are increasingly concerned by the lack of tangible progress in the solution of the main disarmament problems entrusted to the Committee - a situation which became apparent during its last session and which the meetings of the present session have so far confirmed.

4. While stressing that it is the duty of all members of the Conference of the Committee on Disarmament to contribute positively to the work of the Committee, it is their firm belief that primary responsibility rests with the two States which have been exercising jointly the chairmanship of the Committee and which also possess, to an overwhelmingly greater degree, nuclear weapons and other weapons of mass destruction.

5. While reiterating their view that it is most desirable that all nuclear-weapon States participate in the disarmament negotiations, they also reaffirm their opinion that the non-participation of two of those States in the work of the Conference of the Committee on Disarmament should not prevent the Committee from discharging its obligations.

6. It is their conviction that there is no reason which may justify any stagnation of the Committee's work and the current absence of effective negotiations, especially in the case of the following two questions, concerning which the

United Nations General Assembly has repeatedly requested the Committee to deal with as matters of "first" or "high" priority

(a) Cessation of all nuclear-weapon tests, in conformity with the preamble to the Treaty banning nuclear-weapon tests in the athmosphere, in outer space and under water, and

(b) Effective prohibition of the development, production and stockpiling of chemical weapons and the elimination of such weapons from military arsenals of all States, as agreed upon in article IX of the Convention on the prohibition of the development, production and stockpiling of bacteriological (biological) and toxin weapons and on their destruction.

Negotiations in the current phase of the work of the Committee should, therefore, concentrate on the most important questions related to nuclear and other weapons of mass destruction and not on less pressing matters.

7. In the light of the preceding considerations, they believe that it is the duty of all States members of the Conference of the Committee on Disarmament to contribute positively to the progress of the work of the Committee and urge the two States referred to in paragraph 4 above to take the required decisions and necessary measures, including the submission of specific proposals, in order that both the relevant resolutions of the General Assembly and the solemn undertakings assumed in the preamble of the partial test ban Treaty and in article IX of the Convention on the elimination of biological and toxin weapons, may begin to receive effective implementation.

CONFERENCE OF THE COMMITTEE ON DISARMAMENT

CCD/397
24 April 1973
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SWEDEN

Working paper with points to be considered by experts on the verification of ban on underground nuclear explosions

1. Methods and present capabilities for verification

(a) Seismological methods, single or in combination.

(b) Seismological capabilities and limitations.

(c) Other methods for verification, including those using observation from satellites.

(d) Capabilities and limitations of other methods, including those using observations from satellites.

2. Verification aspects of proposed treaty structures

(a) Limitation to national means and international data exchange.

(b) Technical significance of obligatory on-site inspections.

(c) Verification upon request and on-site inspection by invitation.

(d) Limitations to the numbers and strengths of nuclear explosions, including fixed or moving thresholds and phase-outs.

(e) Moratoria.

3. Technical and organizational matters to be settled in connexion with a ban on underground nuclear explosions

(a) Improvements of seismometric networks and stations.

(b) Seismometric data processing, data transmission and data exchange.

(c) Similar aspects of other methods, including those using observations from satellites.

(d) International co-operation and organization for verification of a ban on underground nuclear explosions. The connexion with other international measures of disarmament and arms control. International disarmament organization.

4. General statements and other matters

GE.73-44829
73-10592

CONFERENCE OF THE COMMITTEE ON DISARMAMENT

CCD/398
24 April 1973
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SWEDEN

Working paper presenting the ways in which verification has been dealt with in various arms control and disarmament treaties and proposals

In Document CCD/287, dated 30 April 1970, the Swedish delegation presented some material indicating how the question of verification of collateral arms regulation or disarmament measures had been dealt with in the recent past in agreed treaties and in some of the proposals which had been presented, mainly in the CCD or in the ENDC.

The findings were illustrated by a table. As two new international treaties have been negotiated in the CCD since April 1970, a revised form of the table, also including those treaties, is presented in the Annex to this Paper. The two drafts on general and complete disarmament presented in 1962 by the Soviet Union and the United States have also been included in the new table.

The following treaties and proposals have been chosen:

(a) Treaties

1. The Antarctic Treaty, 1959.
2. Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water, 1963.
3. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies, 1967.
4. Treaty for the Prohibition of Nuclear Weapons in Latin America, "Treaty of Tlatelolco", 1967.
5. Treaty on the Non-Proliferation of Nuclear Weapons, 1968, with the IAEA Safeguards System.
6. Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Sea-Bed and the Ocean Floor and in the Subsoil thereof, 1971.
7. Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their destruction, 1972.

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(b) Proposals

8. Agreed Parts of the Draft Treaty on the Discontinuance of Nuclear Weapon Tests, 1959 (Document on Disarmament, 1960, Appendix I).

9. Soviet Union, Draft treaty on general and complete disarmament under strict international control, 1962 (ENDC/2).

10. United States, Outline of basic provisions of a treaty on general and complete disarmament in a peaceful world, 1962 (ENDC/30).

11. Poland, Memorandum concerning the establishment of a denuclearized and limited armaments zone in Europe, 1962 (ENDC/C. 1/1) and Memorandum on Freezing Nuclear and Thermonuclear Weapons in Central Europe, 1964 (Documents on Disarmament 1964, p. 53).

12. Sweden, Working Paper with suggestions as to possible provisions of a Treaty Banning Underground Nuclear Weapon Tests, 1971 (CCD/348).

ANNEX

Verification system:	1	2	3	4	5	6	7	8	9	10	11	12
1. Collection of information												
obligatory declaration and notification	X		X	X					X	X		
ground, naval and air observation	X					X			X	X	X	
special detection and identification techniques								X				X
international exchange of reports or data				X						X	X	X
2. Inquiry	X			X		X						X
3. On-site inspection by parties												
obligatory continuing, periodic or in a limited number									X	X	X	
on the basis of free access	X		X	X					X	X		
on the basis of consultation, co-operation or invitation			X			X						X
4. International supervision and inspection												
specially established control organization				X				X	X	X	X	
existing organization				X	X							
investigation by the UN Secretary-General												
5. National self-supervision and -inspection	X		X				X					
6. Complaint procedure												
consultation and co-operation	X					X	X	X				X
reference to a conference of the parties	X			X					X		X	
reference to the International Court of Justice	X			X						X		
recourse to the UN Security Council				X		X	X		X	X		X
7. Review of verification system	X			X	X	X	X	X			X	X

CONFERENCE OF THE COMMITTEE ON DISARMAMENT

CCD/399
24 April 1973
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Working paper on problems in determining the body wave magnitude

1. Present importance of body wave magnitude mb in CTB issue

The United Kingdom Working Paper CCD/363 gave a pertinent summary on seismic magnitudes with special reference to CTB discussion. As described there, we have used from the beginning in CTB issues seismic magnitude in terms of mb, body wave magnitude determined by short-period vertical component seismometers almost exclusively. Only recently has the adequacy of applying Ms instead of mb been pointed out and Ms is recommended as representing the equivalent yield better than mb in the Swedish, Canadian and United Kingdom Working Papers (CCD/306, CCD/327 and CCD/363).

However, it must be noted that the above results have been mainly obtained on a research basis and the seismological routine service determines Ms only for a several per cent of all detected seismic events of the globe, but mb for almost all of them. The detection capabilities of the present routine network for surface waves is presently much lower than that for P waves, although the deployment of a high-gain-long-period seismograph network will be able to improve the level. As in CTB the detection and identification of small size events are important, we cannot at least for the moment switch over from mb to Ms to represent the size. Moreover a sudden employment of Ms in place of mb will also confuse people who have been accustomed to use the mb scale for a long time in the CTB issues and it may be premature to switch over from mb to Ms. Also, considering the importance of discrimination by mb:Ms method and some promising short period discriminants, we cannot live without mb. Thus, we should try to obtain the undisputable agreed value of mb for all events in our routine monitoring system for CTB.

2. Fluctuation of body wave magnitude

In CCD/363 the anomalous values of mb at Eskdalemuir Array in Scotland (EKA)*/ for the two United States nuclear explosions, Gasbuggy and Rulison, relative to their yield in kT are described. Namely, mb at EKA is 5.4 for 26 kT Gasbuggy, while mb at

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*/ All seismographic stations have their own three letter abbreviations which are found in "Seismograph Station Abbreviations and Co-ordinates" published by NOAA, United States Department of Commerce or in "Regional Catalogue of Earthquakes" published half-yearly by I.S.C., Edinburgh.

EMA for 40kT Rulison is only 4.7. The CCD/365 gave teleseismic average values of mb for Gasbuggy and Rulison as 5.0 and 4.9 respectively, with less discrepancy in the yields. The bulletin of ISC gives mb 4.8 on 14 observations for Gasbuggy and mb 5.0 on 17 observations for Rulison. The relation between yield and mb looks more reasonable. Another example showing more anomalous relations between yield and mb in CCD/365 are large Soviet chemical explosions Medeo (1) and (2), 1.7 MT and 3.6 MT giving mb 5.0 and 5.2 at EMA respectively. The mb values are too large compared with that of Rulison and Gasbuggy.

It is commonly thought that, although mb at individual stations differs from station to station, their average gives a stable mb with standard deviation less than 1/4 if we take mb at more than 20-30 stations. An individual station mb would very probably show inevitable fluctuations and cannot be considered as a reliable measure of the size of events. If one party uses the mean value of mb obtained at a few arbitrary stations, it is very probable that other parties would not agree about the value and consequently any conclusion derived by using that particular mb cannot be accepted. In the following section an example of such a disagreement will be given.

3. <u>On Tibet-Assam explosion-like seismic events with special reference to their mb values</u>

United States Working Paper CCD/388 was very important and instructive for our CTB issues. It had a constructive side in reviewing recent technical accomplishments which give us hopes of detecting and identifying teleseismic events down to mb 4.0, while in 1960 we considered mb 4.75 a remote target. The several remaining problems mentioned are, of course, all very important and in particular it is to be welcomed that the paper pointed out explicitly the problem of anomalous events, showing concrete examples, which had often been mentioned vaguely against the optimistic opinion on discrimination. Also the problems of mixed events and of the rate of doubtful events in the USSR. It is hoped to give a concrete presentation as for the Tibet-Assam anomalous events which will make possible follow-up examinations and further studies by other parties.

As CCD/388 noted, the existence of anomalous explosion-like earthquakes is very serious and the problem should be investigated carefully. Our examination will be described in the following.

CCD/388 investigated 53 Tibet-Assam shallow seismic events during 1963-1970, of which 50 are listed in its Table IV. Although we feel uneasiness about the accuracy of Ms determination based on stations within narrow range of distance and azimuth from the foci, we did not examine Ms and only re-examined the mb values from the published data source in order to check the anomalous events on the mb:Ms diagram in Fig.5 of CCD/388. We reproduce here the list partly with numbers in chronological order for each event in Table 1. Table 1 shows where each event falls either in the earthquake-like (I), intermediate (II) or explosion-like (III) regions in the mb:Ms diagram adopted in CCD/388. We listed in Table 1 also the mean mb of USCGS (NOAA since July, 1970) and ISC with the number of observations (or stations) used. ISC does not give mean mb when mb is reported by a very few stations, and for such events the mb of individual station with station distance in degrees is given in Table 1 in parentheses.

The left figure of Fig.1 (1A) is a reproduction of Fig.5 in CCD/388 giving order number to be referred to that in Table 1 for the convenience of identifying the events. CCD/388 pointed out two anomalous events above mb 5.0 which lie in the Basham-Marshall explosion region hatched in the mb:Ms diagram in this figure. They are No.12 (8.1, 1965) and No.46 (8.15, 1969). There are three other events in the explosion-like region (Region III) with mb = 5.0, i.e. No.32 (7.13, 1968), No.40 (8.25, 1968) and No.41 (8.29, 1968). CCD/388 takes mb probably from PDE or ELM of NOAA. For several events mb adopted by CCD/388 and mean mb of USCGS given in Bull. ISC are slightly different as indicated by * marks in Table 1. (Nos. 9, 10, 13, 16, 17, 18, 19, 20, 21, 24). Except Nos. 9 and 10, the mean mb's given in Bull. ISC are 0.1-0.2 smaller than mb adopted by CCD/388, which moves the points in mb:Ms diagram in the direction of the earthquake-like region.

The number of observations used to calculate the mean mb can be taken as a measure of the reliability of the mb value. mb of the anomalous event No.12 seems to be based on mb at SHL (India, $\Delta = 7°$)*/ alone. In Bull. ISC we also found mb 4.9 at EKA (Scotland, $\Delta = 67°$), beside mb 5.5 at SHL of Δ of only 7°. To adopt the mb value at near stations is generally questioned and ISC excludes as a rule mb at

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*/ Δ means epicentral distance.

stations $\Delta < 21°$ in the calculation of mean mb. Thus we have to consider that the mb 5.5 of event No.12 is of poor reliability. The simple mean of two mb's at SHL and EKA is 5.2 but more weight should be given to EKA of a greater epicentral distance. Anyway the mb of this event must be much smaller than 5.5, shifting the position in the mb Ms diagram certainly well outside the explosion-like region.

In Fig.2 the number of reported P arrival times and mb values in the Bull. ISC are shown. In the figure the number of P reports of event No.12 of mb 5.2 seems too few compared with other events of the same magnitude. It suggests that even mb 5.2 for No.12 is too large. Thus we cannot agree that this event should be accepted as an example of explosion-like anomalous events.

The mb 5.2 of another anomalous event No.46 is the mean of four stations as shown in Table 2, namely mb 5.0 at GIL (Alaska, $\Delta = 74°$), mb 5.1 at FMR (Alaska, $\Delta = 75°$) and mb 5.7 at BNG (Republic of Central Africa, $\Delta = 76°$) and mb 5.0 at BUL (Rhodesia, $\Delta = 81°$). The mean seems strongly affected by the value at BNG, and a recent investigation by Miyamura, 1972 (Appendix)*/ shows that the station correction to be added to the mb at BNG for central Asian events is -0.13 ± 0.29. It is noticed that the standard deviation of mb variations at BNG is rather large at $\pm$ 0.29. As listed in Table 1, the ISC mean mb for this event is mb 4.9 from 9 observations and according to the above consideration mb 5.2 for this event seems to be somewhat large. Fig.2 indicates that the ISC mean mb 4.9 is reasonable in relation to the number of P reports. Thus we can move this event at least from the explosion-like region to the intermediate region in the mb:Ms diagram by changing mb from 5.2 to 4.9.

Three explosion-like events, Nos. 32, 40 and 41 with mb 5.0 or less are near the border of regions II and III on mb:Ms diagram in Fig.1A and their mb's are based on 4-5 stations as shown in Table 2. ISC mean values based on larger number of observations for them are 0.1-0.2 smaller than USCGS (NOAA) mean values and these events will move from the explosion-like region into the intermediate region.

As Table 1 shows, the mb values of USCGS (NOAA) which CCD/388 adopted, are generally based on fewer observations than the ISC mean. Furthermore ISC excludes near and regional stations to reject effects of regional inhomogeneity of the upper mantle structure on mb values and also the data are obtained in principle by re-examined interpretations. Accordingly, it is reasonable to think that ISC mb is a

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*/ Appendix is available at the Secretariat of CCD.

better estimate of mb than NOAA mb which is rather preliminary. Adopting ISC mean mb's and Ms's of CCD/388, we constructed mb:Ms diagram as shown in Fig. 1B. This latter diagram shows no point in the explosion-like region (Region III) for all magnitude ranges. There remain many events of mb less than 5.0 in the intermediate region (Region II), but no event with mb $\geq$ 5.0 is even in the intermediate region. The Tibet-Assam shallow seismic events are thus considered to be all normal earthquake-like events at least for mb not less than 5.0 and they are clearly separated from explosion-like as well as from the intermediate region in the mb:Ms diagram, when we adopt ISC mean mb. We cannot deny that many events with mb less than 5 are in the intermediate region. However, it is still open for discussion whether we could extend the explosion-like region bounded by Ms = 0.5 mb - 1.5 to the unhatched region of mb less than 5.

Anyway, we have reached a somewhat different conclusion on the Tibet-Assam "anomalous" events and this new interpretation arises only from the mb values adopted. It indicates that the determination of mb on a more appropriate basis is necessary to apply mb:Ms method of discrimination for CTB. For the discussion of the threshold of verification, an agreement on mb value for each seismic event is also necessary.

Although it is very difficult to approach the true value of mb, the urgent need is to reach an agreement on the determination of mb, namely, by what method and on what data. We made some preparatory work to select reliable stations for the mb determination in the existing international seismological routine in order to provide a practical basis for this problem.

4. Selection of reliable stations for the routine determination of body wave magnitude for CTB

More than 500 seismological stations in different countries of the world are now co-operating in the routine rapid service of Preliminary Determination of Epicenters (PDE) of National Oceanic and Atmospheric Administration (NOAA) of United States Department of Commerce in sending their seismometric interpretations by telegram or by air-mail every day or every week. The collected data are used to calculate the epicenter co-ordinates, focal depths and magnitudes by computer and the results are printed and distributed as PDE after a couple of months to the contributing stations, interested institutes and individual scientists of the world. All data used in PDE are also published as Earthquake Data Reports (EDR) subsequently. The seismic events of the world are now routinely detected and located by this rapid service and when we discuss the detection and identification of underground nuclear explosions, it is indispensable to be well acquainted with the present state of this service in order to investigate a practically feasible seismic verification system for CTB.

As reviewed in CCD/363 short-period body wave magnitudes have been systematically determined in PDE service for almost all seismic events located and have now become a useful measure of the size of event down to the smallest detectable earthquakes. However, as described in the previous sections with reference to United Kingdom and United States Working Papers, fluctuation of mb is very critical in relation to the seismological verification for explosions. It is necessary to avoid argument about the adopted magnitude values among the parties when the estimation of event size or discrimination needs the magnitude values. Especially, when the mb differs from station to station very much for a certain event and consequently different mean mb's are obtained for different combination of stations, we need to have a mutually agreed magnitude value.

For the routine monitoring of earthquakes, PDE service seems to be the only workable basis at present and we investigated the actual state of the mb determination of PDE. The details of the investigation can be found in the paper of Miyamura, 1972 given as Appendix. Station biases of mb for different stations are obtained for the NTS and E. Kazakh explosions separately.

As is shown in Appendix, reliable teleseismic stations for mb determination are as follows:

1. for NTS: CPO (USA); PMR, COL, GIL (Alaska); LPS (El Salvador); MBC, NP-, ALE(Canada); SJG (Puerto Rico); CAR (Venezuela); KTG (Greenland); LPB (Bolivia); KJN, NUR (Finland); TSK (Japan); BNS, GRF, FUR (FRG); MOX, CLL (GDR)
2. for E. Kazakh: NDI, SHL, POO, HYB (India); NUR, KJN, KEV (Finland); COP (Denmark); CLL, MOX (GDR); GRF, FUR, STU, BNS (FRG); NOR, KTG (Greenland); TSK, OIS (Japan); GIL, COL, PMR (Alaska); NP-, MBC, INK, CMC, FBC, GWC, FSJ, EDM, PNT (Canada); BNG (Republic of Central Africa); BUL (Rhodesia); PRE (South Africa); NEW, LON, LPA, LAO, BOZ, EMO, DUG, UBO, EUR, GOL, BKS, CPO, ALQ, WMO, TFO (USA); MUN, PMG (Australia).

Comparing the total number of stations reporting P arrival times to NOAA, the number of the above stations seems to be very small and in reality quite insufficient for reliable mb determination.

There are many other sensitive stations such as UPP, KIR, UME, HFS (Sweden), SOD (Finland), KHC, PRU (Czechoslovakia), MAT, DDR (Japan), YKC (Canada), WRA, ASP (Australia), SPA (Antarctica), etc. which have certainly a potentiality for reporting mb data but have not been sending them to NOAA. For example, MAT has begun reporting mb recently with fair reliability. We can include some of them and invite many others to report regularly not only P arrival times but also mb data to NOAA.

It is quite regrettable that some of the above-mentioned reliable stations such as WMO and TFO discontinued their reports to NOAA recently. Geographically uneven distribution of reliable stations for mb determination is clearly observed as shown in Figs. 11 and 12 of Appendix with respect to the epicenters and more reports from the vast blank areas of Asia, Africa and South America are especially needed.

In order to select key stations for the mb determination of seismic events in the different parts of the world, the present investigation suggests that the urgent need is to increase the reporting stations. To begin with, we have to use the above selected stations plus several reliable sensitive stations such as MAT, HFS, YKC, etc.

A rapid seismological routine service based on many stations in many different parts of the world like PDE service is indispensable to the verification for CTB. Monitoring only by a small number of array stations may not be sufficient to secure unbiased mb values of seismic events in various parts of the world, though this problem has not yet been fully examined.

Table 1

NO.	CCD/388 DATE M	D	Y	TIME H	M	MAG. mb	Ms	REGION	USCGS mb/NO. OF OBS. /(SAT.)	PDE NO.	ISC mb/NO. OF OBS. /(STA. Δ)
1	07	05	63	07	19	4.2	3.90	I			
2	10	08	63	02	51	5.4	4.33	II			
3	11	16	63	11	39	4.7	3.93	I			
4	01	07	64	04	50	5.0	4.38	I	5.0/COL		(5.0/COL,72°)
5	01	27	64	05	29	4.9	3.87	II	4.9/COL		(5.4/COL,74°)
6	04	30	65	07	13	4.4	3.96	I	4.4/COL		(4.5/COL,75°)
7	06	04	65	15	56	5.0	3.87	II	5.0/2		(5.3/SHL,7°, 4.8/COL,72°)
8	07	31	65	16	36	4.9	4.27	I	4.9/2		4.8/3
9	07	31	65	17	07	4.7*	4.81	I	4.8/4		5.0/7
10	07	31	65	19	01	4.4*	4.40	I	4.7/4		4.8/8
11	07	31	65	21	44	4.9	4.60	I	4.9/4		5.0/9
12	08	01	65	14	14	5.5	3.94	III	5.5/SHL,7°	67	(5.5/SHL,7° 4.9/EKA,67°)
13	08	01	65	20	09	5.3*	4.78	I	5.2/8	63	5.2/15
14	08	02	65	17	49	4.8	4.35	I	4.8/4	71	4.7/4
15	10	06	65	08	03	5.4	4.19	II	5.4/3	79	4.9/4
16	12	09	65	20	26	5.3*	4.47	I	5.1/3	44	5.0/6
17	01	31	66	02	35	5.6*	4.87	I	5.4/12	6	5.1/18
18	03	14	66	04	42	4.9*	4.46	I	4.8/7	17	4.8/10
19	05	27	66	14	35	4.8*	4.34	I	4.7/6	36	4.7/8
20	09	11	66	15	55	5.0*	3.77	II	4.8/STU,BUL	67	4.7/5
21	09	26	66	05	10	5.6*	5.26	I	5.5/14	67	5.4/25
22	09	36	66	06	03	4.2	3.59	I	4.2/POO,20°	74	(4.1/POO,19°)
23	03	11	67	16	56	5.3	4.69	I	5.3/12	19	5.1/20
24	03	14	67	06	58	5.9*	5.54	I	5.8/16	16	5.7/32
25	07	07	67	22	56	4.9	3.71	II	4.9/STU,COL	47	4.8/5

Table 1 (cont'd)

26	08	15	67	09	21	5.7	5.07	I	5.7/15	55	5.5/28
27	02	16	68	05	37	4.8	4.51	I	4.8/6	11	4.7/9
28	06	28	68	20	34	4.8	3.58	II	4.8/3	48	4.8/8
29	06	30	68	05	04	4.8	3.40	II	4.8/3	54	4.7/6
30	07	01	68	03	11	4.3	3.00	II	4.3/BUL,81°	53	4.0/4
31	07	04	68	06	45	4.7	3.46	II	4.7/3	48	4.7/11
32	07	13	68	06	05	5.0	3.46	III	5.0/5	56	4.8/9
33	07	14	68	18	12	4.9	3.54	II	4.9/6	54	4.8/12
34	07	15	68	05	09	4.8	3.39	II	4.8/COL,73°	60	4.7/6
35	07	16	68	22	23	4.8	3.45	II	4.8/4	54	4.6/8
36	07	23	68	20	51	4.9	3.43	II	4.9/4	59	4.8/10
37	07	26	68	12	44	4.9	3.45	II	4.9/5	61	4.7/9
38	08	23	68	12	01	4.8	3.46	II	4.8/4	64	4.7/10
39	08	24	68	14	26	4.6	3.35	II	4.6/SHL,COL	68	4.8/5
40	08	25	68	17	55	4.8	3.28	III	4.8/4	64	4.7/5
41	08	29	68	19	51	5.0	3.48	III	5.0/4	67	4.9/9
42	09	01	68	05	59	5.0	3.59	II	5.0/5	72	4.8/9
43	09	03	68	17	45	4.9	3.43	II	4.9/3	68	4.8/12
44	09	04	68	01	40	4.8	4.05	I	4.8/COL,70°	70	(4.9/COL,72°)
45	09	11	68	03	07	4.3	3.52	I	4.3/BNG,76°	72	4.7/7
46	08	15	69	07	15	5.2	3.57	III	5.2/4	55	4.9/9
47	11	24	69	02	01	4.6	4.00	I	4.6/5	77	4.6/8
48	02	08	70	19	07	4.5	4.05	I	4.5/4	15	4.5/6
49	05	08	70	11	08	4.5	3.55	I	4.5/KJN,NP-	33	
50	06	24	70	00	34	4.8	4.53	I	4.8/8	45	

Table 2

EVENT	EDR 63-68 SAT.	DIST.	mb	STA.	DIST.	BULL mb	ISC STA.	DIST.	mb
No. 12	SHL	7.2	5.5	SHL	7.2	5.5	EKA	67.5	4.9
	mb on 1 obs.		5.5	no ISC mean is given					
No. 32	NP-	71.6	4.9	KJN	53.1	5.1	BNG	75.9	5.1
	COL	73.5	4.8	MOX	63.1	4.9	KRR	78.3	4.8
	BNG	75.8	5.0	FUR	64.0	5.2	BUL	81.0	4.8
	BUL	80.9	4.9	NP-	71.5	5.0	mb on 9 obs.		4.8
	mb on 4 obs.		5.0*	COL	73.5	5.0			
				CLK	73.5	4.9			
No. 40	SHL	5.4	4.9	SHL	5.4	4.9	BUL	81.0	4.8
	GIL	73.5	4.7	PRU	61.4	4.8	mb on 5 obs.		
	PMR	74.9	4.7	GIL	73.5	4.8	excluding		
	BUL	81.1	4.8	PMR	74.9	4.7	SHL		4.7
	mb on 4 obs.		4.8	BHA	77.8	4.8			
No. 41	NUR	54.6	5.3	NUR	34.6	5.3	PMR	75.0	5.0
	COL	73.4	4.9	PRU	61.6	5.0	BHA	77.8	4.9
	PMR	74.9	5.0	KON	62.1	5.3	CIR	79.4	4.7
	BUL	81.2	4.6	CLK	73.5	5.0	BUL	81.0	4.7
	mb on 4 obs.		5.0	COL	73 5	4.9	mb on 9 obs.		4.9
No. 46	GIL	73.5	5.0	KHN	53.1	4.9	BNG	75.8	5.8
	PMR	75.0	5.1	MOX	63.0	5.0	KRR	78.2	4.6
	BNG	76.1	5.7	FUR	63.9	5.1	CIR	79.3	4.5
	BUL	81.1	5.0	GIL	73.6	5.0	BUL	80.9	4.7
	mb on 4 obs.		5.2	PMR	75.0	5.1	mb on 9 obs.		4.9

Captions for Tables and Figures

Table 1. Tibet-Assam shallow earthquakes investigated in CCD/388 as including explosion-like seismic events. mb adopted in CCD/388 is slightly different from mb given in Bull. ISC.

Table 2. Station mb in EDR for Tibet-Assam events suspected as explosion-like in CCD/388.

*Arithmetic mean is 4.94.

Fig. 1. mb: Ms diagrams of Tibet-Assam shallow earthquakes investigated in CCD/388 as an example of population including explosion-like seismic events. 1A is mb: Ms diagram same as in Fig. 5 of CCD/388. Numbers attached to the points are the chronological order of numbers given in Table 1. 1B is mb: Ms diagram, taking ISC mean mb instead of mb adopted by CCD/388 from USCGS (NOAA).

I, II and III are earthquake-like, intermediate and explosion-like regions in the mb: Ms diagram adopted by CCD/388 and the hatched part is explosion domain by Basham-Marshall, 1972.

Fig. 2. The relation of the number of P arrival time reports N and mean mb by ISC

FIG. 1. mb : MS DIAGRAM FOR TIBET-ASSAM SHALLOW SEISMIC EVENTS

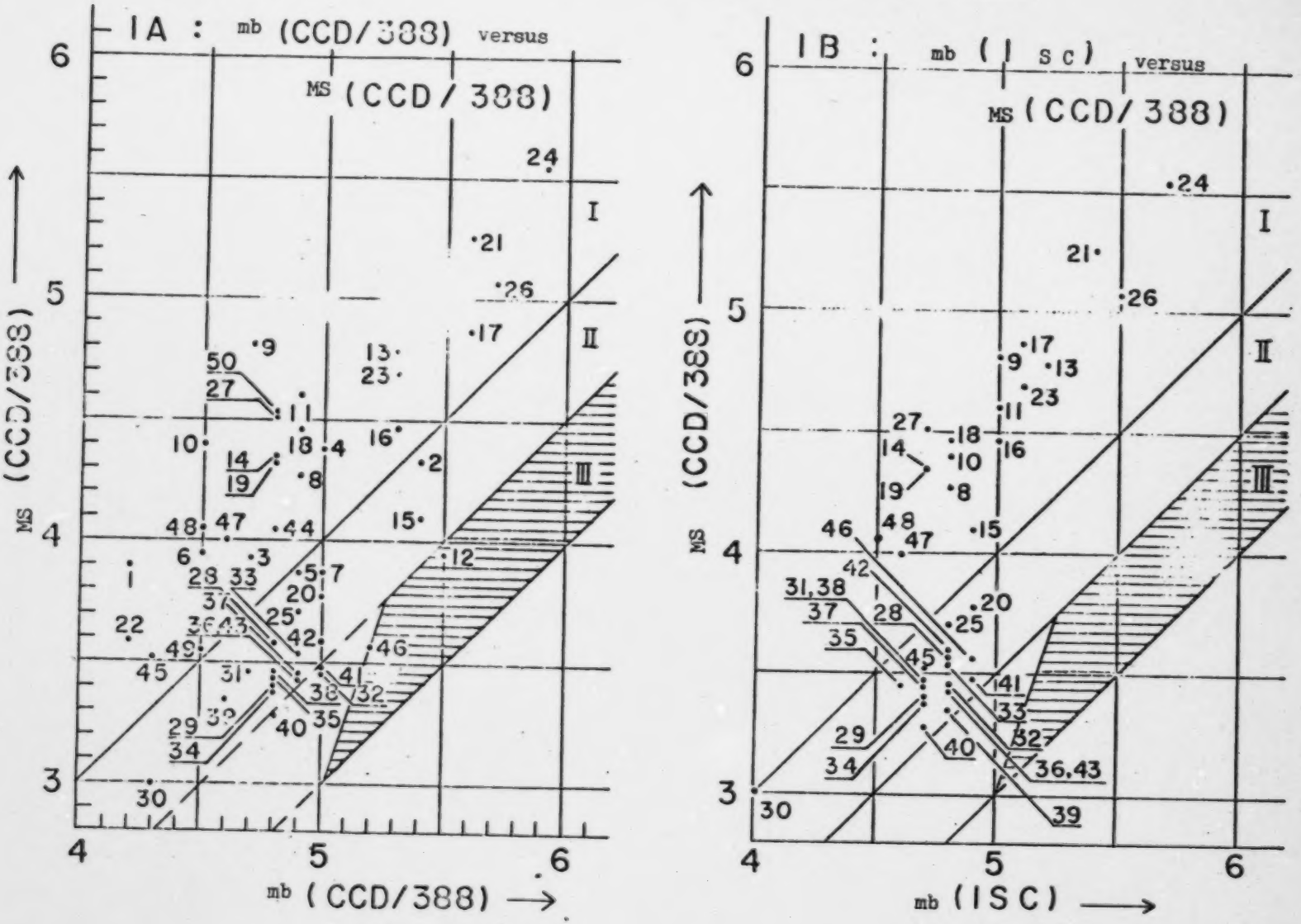

FIG. 2. NUMBER OF P REPORT AND mb OF TIBET-ASSAM SHALLOW SEISMIC EVENTS